Potential Conflict between Future Development of Natural Resources and High-Value Wildlife Habitats in Boreal Landscapes

Biodiversity and Conservation

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Online Resource 4. Mineral Potential

We created GIS layers of mineral potential for the Muskwa-Kechika Management Area (hereafter referred to as the Muskwa-Kechika) by integrating spatial data available from British Columbia (BC) government sources. These data included 1) BC mineral potential (British Columbia Ministry of Energy and Mines 1998), 2) coal geology from BC digital geology data (British Columbia Ministry of Energy and Mines 2013), 3) mineral tenures (British Columbia Ministry of Energy and Mines, British Columbia Government Mineral Titles and Policy Branch 2005), and 4) mineral occurrence (British Columbia Ministry of Energy and Mines, Geological Survey Branch 2005).

BC Mineral Potential Database. BC mineral potential database in a shapefile (minpot_bc_alb, Mineral Resource Assessment Level 1; British Columbia Ministry of Energy and Mines 1998) included province-wide information on inventory and distribution for both metallic minerals (e.g., copper, silver, iron, zinc, lead) and industrial minerals (e.g., limestone, phosphate, magnesite, and barite). In this database, the entire land area of BC was divided into 794 tracts of polygons based on common geologic characteristics. These 794 tracts were ranked from 1 (lowest) to 794 (highest) based on likelihood of discovering new metallic mineral and industrial mineral resources (British Columbia Ministry of Energy and Mines 1998). The ranking was given separately for metallic mineral (Fig. S4.1a) and industrial mineral (Fig. S4.1b) resources. In the actual data files, there were 795 mineral tracts, in which 0 was the lowest rank, instead of 1, and 794 was the highest. To create a combined mineral potential of metallic and industrial minerals in the Muskwa-Kechika, we averaged rank values of metallic mineral and rank values of industrial mineral for each of 795 tracts (Fig. S4.1c). We cropped the land area of the Muskwa-Kechika from the combined mineral potential layer (Fig. S4.1d) and created scores of mineral potential in the Muskwa-Kechika that are comparable to those of other lands in BC.

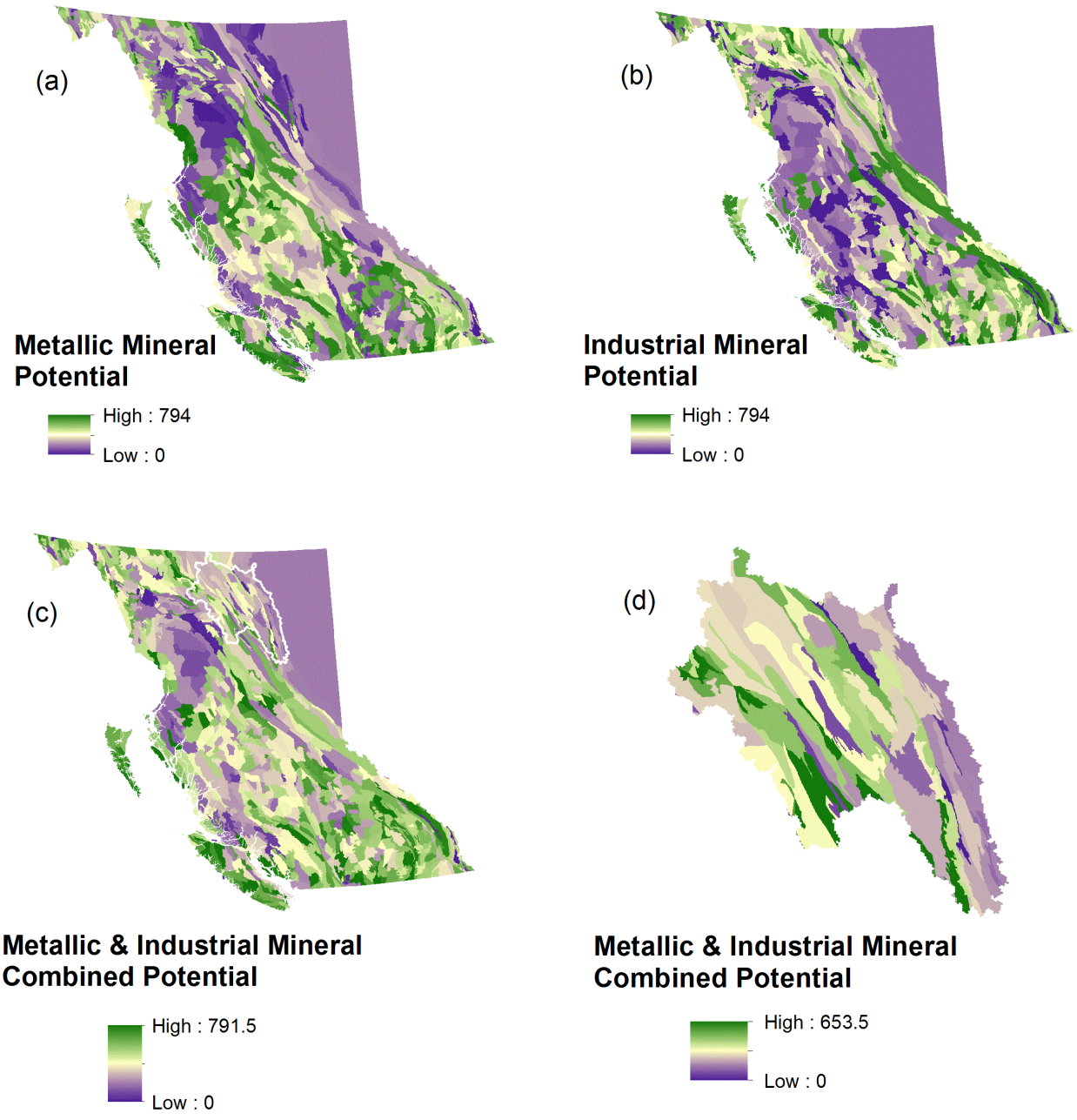

Fig. S4.1 British Columbia (BC) province-wide mineral potential for 795 mineral tracts of metallic minerals (a) and industrial minerals (b). The combined potential is the average value between metallic mineral potential and industrial mineral potential for each 50-m pixel across BC (c). The combined metallic and mineral potential was extracted specifically for the Muskwa-Kechika Management Area, northeast BC (d)

Coal Geology (*Gething Formation*). The BC Mineral Potential Database does not include inventory information on coal because coal is not strictly considered to be a mineral resource. However, we integrated a coal resource potential into the combined potential of metallic and industrial minerals created in the previous process because effects of coal mining on wildlife habitats are likely similar to those for metallic and industrial minerals. To identify areas of coal potential, we used the BC Digital Geology Data Version 2.1 (British Columbia Ministry of Energy and Mines 2013) and mapped the distribution of the Gething Formation, which has been known to contain coal deposits (Ryan and Lane 2006), in the Muskwa-Kechika (Fig. S4.2). Areas of the Gething formation are highly clustered in the southeast corner of the Muskwa-Kechika and additional patches occur just south of the east-central border of the Muskwa-Kechika. These areas of the Gething Formation comprise less than 1% of the area of the Muskwa-Kechika, but coincide with previous coal tenure applications in the southern part of the formation. To our knowledge there is no provincial ranking of coal inventory comparable to metallic and industrial minerals. Because areas of the Gething Formation were not specifically recognized in the BC mineral tracts data, we ranked these areas below median mineral potential for both metallic and industrial minerals. We used the average value between median rank value of metallic mineral potential and median rank value of industrial mineral potential in the Muskwa-Kechika to represent the rank value of coal potential. Median rank value of metallic minerals was 191 and median rank value of industrial minerals was 389 in the Muskwa-Kechika; therefore, coal potential for the area of the Gething formation was set at 290 and at 0 for the rest of the Muskwa-Kechika. We added the coal potential to the combined metallic and industrial mineral potential to create a combined potential of coal, metallic and industrial minerals. Because the potential for metallic minerals and industrial minerals is low in these areas, the addition of the coal potential did not overly inflate the overall combined potential of coal, metallic and industrial minerals.

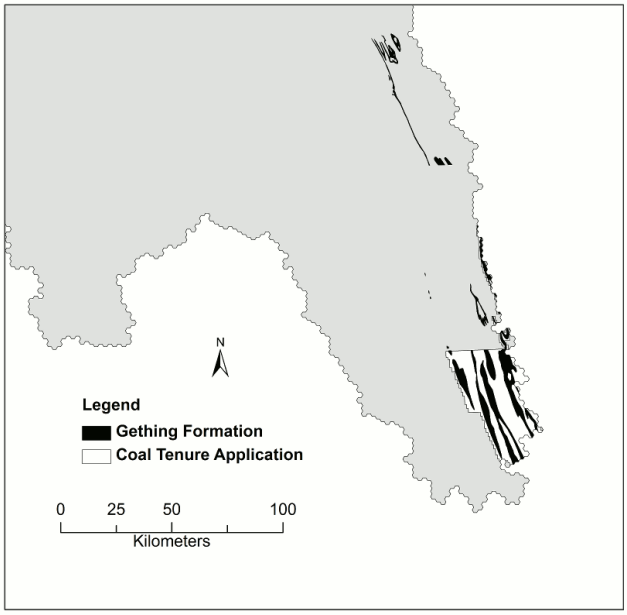

Fig. S4.2 The occurrence of the Gething Formation, which is known to bear coal deposits, in the southeast portion of the Muskwa-Kechika Management Area, some of which overlaps areas of previous coal tenure applications, northeast British Columbia

Mineral Tenure Data. Because previous and current resource tenure sites are more likely to be developed again than the rest of the landscape without a history of mining, we added values that account for mineral tenure sites being targeted for resource extraction. We identified mineral tenure sites in the Muskwa-Kechika (Fig. S4.3) from a polygon shapefile of BC mineral tenure data designated for mineral and placer claims / leases as well as coal licenses / leases and their applications (British Columbia Ministry of Energy and Mines, British Columbia Government Mineral Titles and Policy Branch 2005). We increased values of the underlying combined potential of coal, metallic and industrial minerals by 20% to account for more probable exploration and extraction in areas of mineral tenure polygons.

Mineral Occurrence Data. We also increased values of mineral potential at known geographic locations with geologic and economic information on discovered mineralization; including occurrence of metallic minerals, industrial minerals, and coal; as indicated by the MINFILE Mineral Occurrence Database (British Columbia Ministry of Energy and Mines, Geological Survey Branch 2005). We considered MINFILE points classified as DEVELOPED PROSPECT and PROSPECT in the provincial mineral tracts polygons to be potential centers from which mining activities could be initiated (Fig. S4.3). We increased values of the underlying combined mineral potential by 10% and 5% for MINFILE point classified as DEVELOPED PROSPECT and PROSPECT, respectively. These increases were limited to planning units (Fig.1b, main text) with classified MINFILE points and also to a specific mineral tract within which a classified point occurred within a planning unit. There were no instances where 2 MINFILE points occurred within a single planning unit.

The 10% and 5% increases were applied to the base value of the combined potential of coal, metallic and industrial minerals independent of the 20% increase applied for tenure polygons in the previous process. Therefore, an area of mineral tract with DEVELOPED PROSPECT within a planning unit overlapping a mineral tenure polygon would receive a 30% increase (10% from classified as DEVELOPED PROSPECT and 20% from the location within a tenure polygon) from the base value of combined potential of coal, metallic and industrial minerals. Similarly, an area of mineral tract with a classification of PROSPECT within a planning unit overlapping the tenure polygon would receive a 25% overall increase (5% increase from PROSPECT and 20% increase from being in a tenure polygon).

Final Mineral Potential Layer. We completed the final mineral potential layer at the 50-m pixel level (Fig. S4.4), once 20% increase for tenure polygons and 10% and 5% increase for classified MINFILE points were applied to base values of combined potential of coal, metallic and industrial mineral across the Muskwa-Kechika. To create a final mineral potential layer at the 500-ha planning unit level (Fig. 1b, main text), we averaged pixel level mineral potential for each planning unit across the Muskwa-Kechika (Fig. S4.5).

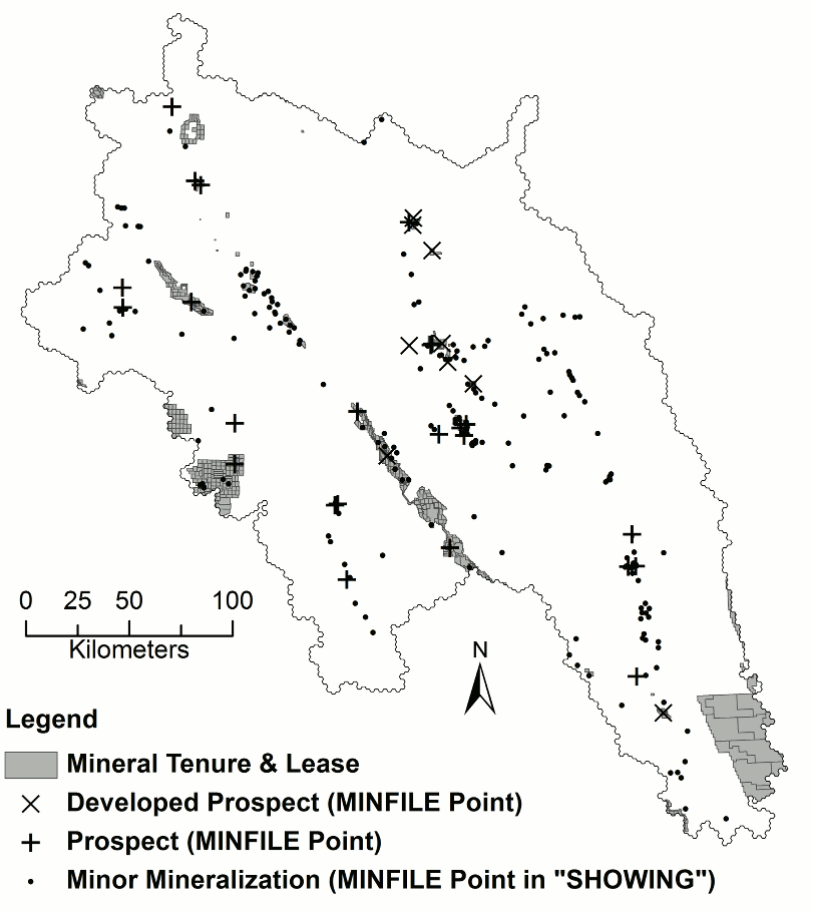

Fig. S4.3 Distributions of previously existing and applications for mineral tenures and leases, as well as British Columbia MINFILE points in DEVELOPED PROSPECT and PROSPECT categories in the Muskwa-Kechika Management Area, northeast British Columbia. MINFILE points in the "SHOWING" category, where only minor mineralization was found, are included in the figure for display purposes only

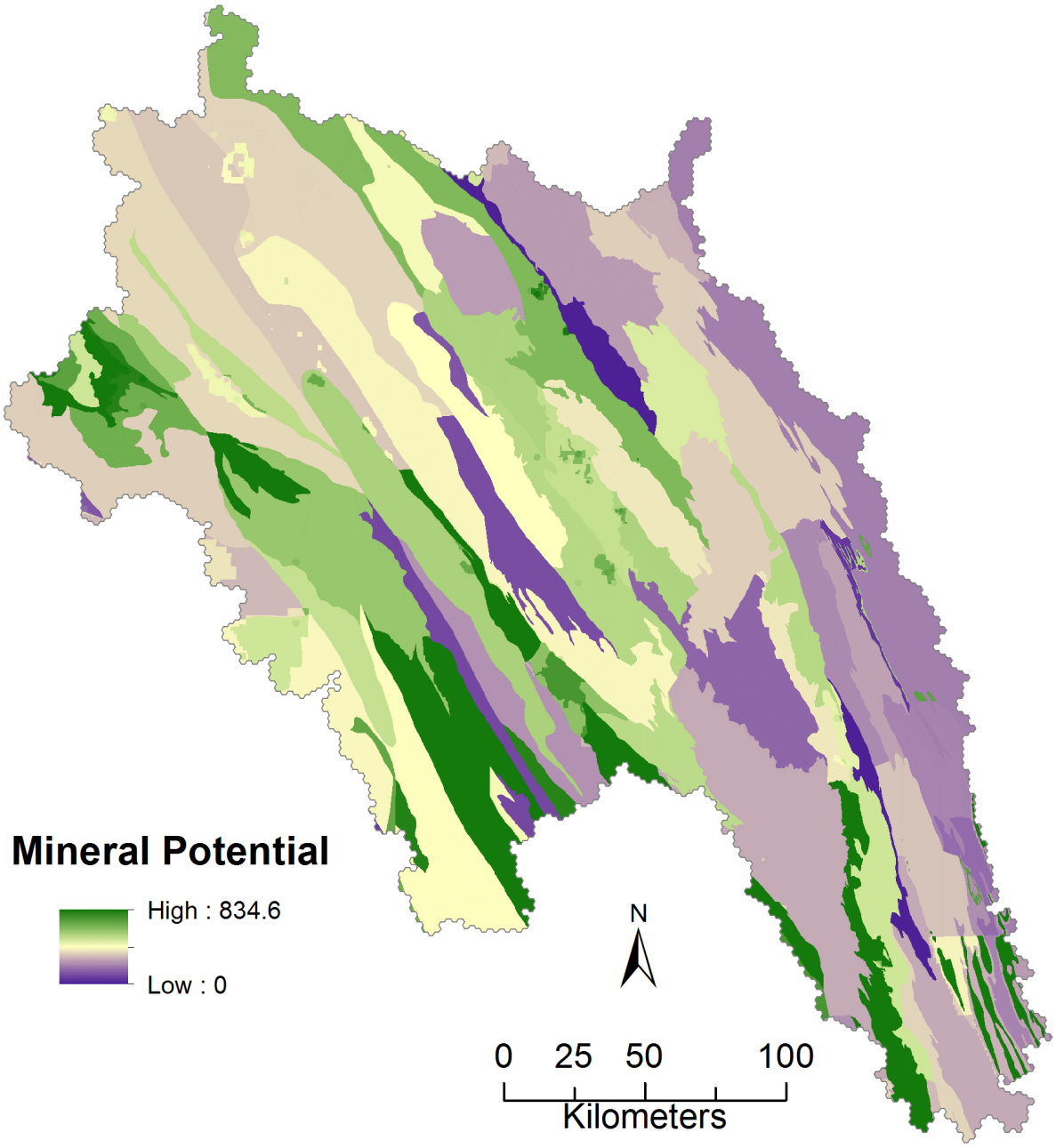

Fig. S4.4 Final mineral potential of the Muskwa-Kechika Management Area in northeast British Columbia (BC) at a 50-m pixel scale. Mineral potential was based on provincial mineral potential, presence of coal geology (Gething Formation), mineral tenure locations, and BC MINFILE points with PROSPECT and DEVELOPED PROSPECT

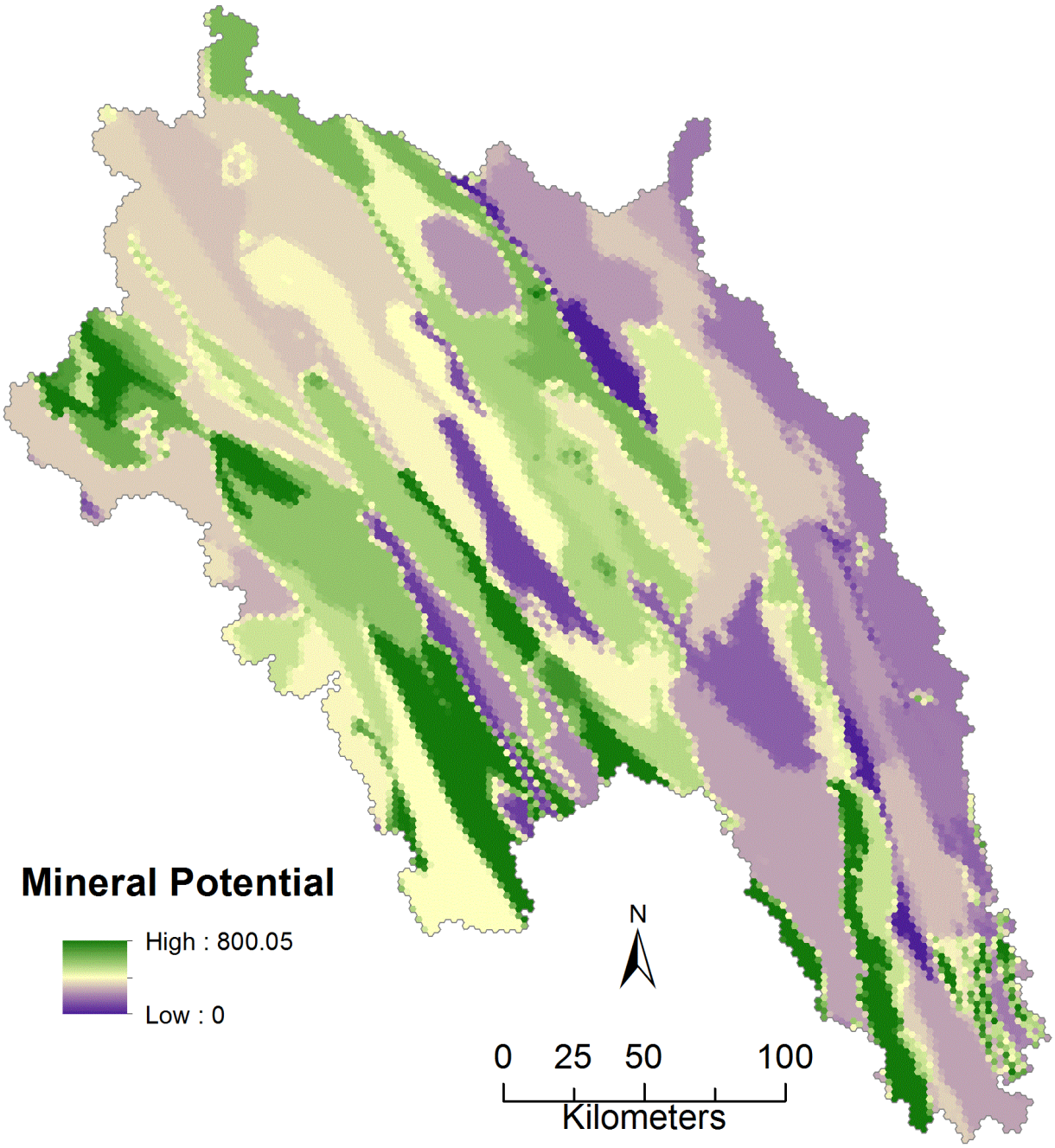

Fig. S4.5 Final mineral potential of the Muskwa-Kechika Management Area in northeast British Columbia (BC) for 500-ha planning units. Mineral potential was based on provincial mineral potential, presence of coal geology (Gething Formation), mineral tenure locations, and BC MINFILE points with PROSPECT and DEVELOPED PROSPECT

References

British Columbia Ministry of Energy and Mines (1998) Mineral Resource Assessment Level 1(minpot_bc_alb). Available at: (http://www.empr.gov.bc.ca/Mining/Geoscience/MapPlace/geoData/Pages/default.aspx). Accessed 15 February 2014

British Columbia Ministry of Energy and Mines, Geological Survey Branch (2005) MINFILE, mineral occurrence database. Available at: http://catalogue.data.gov.bc.ca/dataset/minfile-mineral-occurrence-database. Accessed 12 February 2014

British Columbia Ministry of Energy and Mines, British Columbia Government Mineral Titles and Policy Branch (2005) MTA-mineral, placer and coal tenure SVW. Available at: http://catalogue.data.gov.bc.ca/dataset/mta-mineral-placer-and-coal-tenure-gov-svw. Accessed 12 February 2014

British Columbia Ministry of Energy and Mines (2013) British Columbia Digital Geology Data Version 2.1. Available at: http://www.empr.gov.bc.ca/Mining/Geoscience/BedrockMapping/Pages/BCGeoMap.aspx. Accessed 14 February 2014

Ryan B, Lane B (2006) Coal utilization potential of Gething Formation coals, northeast British Columbia. Pages 49-72 in Summary of Activities 2006, British Columbia Resource Development and Geoscience Branch, British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria, British Columbia, Canada